Glossary of Technical Terms

ablation — the rapid wearing away of contaminated surface material through application of heat and pressure

absorption — the dissolving of one compound, usually a gas into a liquid or a liquid into a solid

actinide — any element whose nucleus naturally contains between 89 to 103 protons

activated carbon — fine granular form of carbon with high surface area and the ability to adsorb organic compounds

adsorption — the physical attachment of one chemical compound to another

aerobic cometabolism — the uptake or conversion of hazardous substances as a result of the natural chemical and physical processes of microorganisms in the presence of oxygen

alkaline — having the properties of a base compound (high pH)

alpha particles — helium nuclei (He^{++})

amalgamation — physically combining two or more metals to produce an alloy with different properties than any of the original metals, often involving mercury

amostile — a commercial form of asbestos in the form of long fibers made of one of several closely related minerals

anaerobic — a process that occurs in the absence of oxygen

analyte — a specific component measured in a chemical analysis

anisotrophy — the characteristic of a substance for which the value of a physical property, such as index of refraction, varies with the direction in or along which the measurement is made

aquifer — a geologic formation or structure capable of yielding water in useable quantities

aquitard — a bed of low permeability rock adjacent to an aquifer confining its flow

base — a (typically) water-soluble compound containing an excess of negatively charged hydroxyl ions and therefore capable of combining with unbound protons (hydrogen ions)

bench-scale testing — testing of a new process or device at a very small scale to validate performance prior to more expensive pilot testing

beta-emitting — disintegrating through the emission of a negative or positive electron; beta particles have a short range in air and a low ability to penetrate other materials

biodegradation — the gradual destruction of a material due to natural or artificially induced biological activity

biomass — organic material usually plant and animal waste, especially used as fuel

bioremediation — destruction or removal of contamination through natural or artificially induced biological activity

biosorbents — organisms (usually bacteria) that remove contaminants from waste streams

calcine — a material that has been raised to high temperatures to drive off volatile matter

characterization — sampling, monitoring, and analysis to determine the extent and nature of contaminants present. Characterization provides necessary technical information to develop, screen, and select appropriate cleanup technologies. associated with living entities

chelating — capable of forming a ring-shaped molecular structure locking a metal ion in place thereby reducing its activity

chlorinated solvent — any organic liquid containing chlorine atoms in its molecular structure

chromatogram — a common analytical and characterization technique that generates a graph showing the separate components of a chemical sample (The method or medium used to perform the separation is usually described in the name. Thus, if gas is used as the separating medium, the term *gas chromatogram* is used.)

chrysotile — the most common commercial form of asbestos, in which the fibers have a hollow structure formed from rolled-up sheets of magnesium oxide and silicon oxide

colloidal — relating to an intimate mixture of two substances, one of which (the *colloid*) is uniformly distributed in a finely divided state throughout the second substance

complexant concentrate — an organic liquid that has been used to draw out an inorganic material, such as cesium, from a solid material and chemically bind it as an intermediate waste form prior to final processing

cone penetrometer — a relatively fast and minimally intrusive means of delivering a variety of sensors to a tank interior or subsurface areas as much as tens of meters below ground level to characterize or monitor subsurface conditions

cryogenic — utilizing refrigerants to achieve very low temperatures

cyclone melter — a device that rapidly melts and spins vitrified material to the outer walls by centrifugal force, allowing separation and capture of volatile materials to increase glass stability upon cooling

depleted uranium — uranium from which the highly radioactive (fissionable) isotopes have been removed

desorption — a process usually involving heat in which a liquid is converted to a gas, allowing it to be removed from solids

dig face — the active top or side of an excavation, or dig

dosimeter — an instrument that measures the total dose of nuclear radiation received in a given period

effluent — any material (e.g., water and air) that leaves a system during processing

electrokinetic — relating to the movement of charged particles in electric or magnetic fields usually in an aqueous medium

electro-osmosis — the induced ground-water flow as a result of an underground electric field set up to draw positively charged ions dissolved in the ground water away from mineral particles (which typically exhibit negative charges on their surfaces) for capture and separation

end effector — any attachment to the end of a robotic arm that performs (“effects”) some task on an environment by remote control

ex situ — removed from its original location

FentonÕs chemistry — a technique developed in the 19th century for inducing oxidation by use of the chemical hydrogen peroxide

ferric — denoting compounds of iron in which the iron is in the trivalent (3+) state

ferrous — denoting compounds of iron in which the iron is in the divalent (2+)

state

fissile material — atoms with nuclei capable of fissioning (splitting) into two

fluorescence — the emission of light during, and as the result of, absorption of some other radiant energy

full-scale demonstration — testing a technology under conditions that are as realistic as possible, generally the final step before implementation

gamma ray — a small highly energetic radiation similar to x-rays but shorter in wave length

gas chromatograph — an instrument used in the quantitative analysis of volatile compounds, involving passage of a gaseous phase through a column containing a fixed adsorbent phase

gaseous diffusion plant — a facility designed to separate uranium isotopes from each other (to increase the percentage of fissionable material) by taking advantage of the fact that diffusion rates differ between various isotopic forms of a gaseous molecule

gel — an open structured material with high water content (typically greater than 90%) showing a degree of structural stability

glove box — a sealed box with gloves attached and passing through openings into the box so that workers can safely handle hazardous materials

grout — a slurry of cement, ash, sand, and water, used to form a concretelike solid

gunite — a corrosion- and temperature-resistant concrete used as lining for structures such as tanks, chimneys, and pools expected to maintain integrity under extreme conditions

half-life — the period during which half of a sample of a given element will undergo radioactive decay

hazardous waste — a solid waste or combination of solid wastes that, because of its quantity, concentration, or chemical, physical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or pose a substantial threat to human health or the environment

heavy metal — one of a large group of common and rare metals that occupy the center section of the periodic table and have more than 20 protons in their nuclei, making them relatively heavy, typically toxic to humans in various concentrations

high-level waste — the highly radioactive remains from the reprocessing of spent nuclear fuel, including liquids and solids

hot cell — a lead-shielded, sealed work space in which highly radioactive materials can be manipulated by remote control

hydraulic conductivity — the rate of water flow through soil, expressed in gallons per day through a cross section of 1 square foot

hydrocarbon — one of a large group of chemical compounds composed primarily of hydrogen and carbon

hydrolysis — decomposition or alteration of organic compounds by interaction with water

in situ — in the original location

ion — an atom with an electrical charge because it has more or fewer electrons than the number of protons in its nucleus

ion exchange — a class of chemical reactions involving a liquid and solid where the solid exchanges a weakly bound ion in its structure for a preferred ion from the liquid

isotope — atoms of the same element that have a different atomic weight

K-edge energy — the energy of an impinging X-ray that will drive an electron lying in the shell closest to the nucleus completely out of the atom. This energy is unique for every element and can therefore be used to identify what element the X-ray beam is striking.

leaching — the removal of compounds by percolation of liquids (e.g., coffee results from the leaching of compounds in coffee beans into water)

leach resistant — any material that is stable enough to prevent outside materials from removing any stored waste components

life-cycle cost — the discounted (i.e., expressed as if occurring at a common point in time) total costs from inception to final disposition associated with an action. In the context of environmental technology development, such costs may include research and development costs; capital, labor, and financing costs to construct prototype and commercial-scale units; maintenance and operating costs; licensing costs (or revenues); decontamination, decommissioning, and monitoring costs for the equipment; incurred (or avoided) costs for environmental damages; and incurred (or avoided) costs for health effects.

ligand — a molecule with a chemical structure which permits it to bind with a target molecule

lithology — physical properties of granular soil, sediment or rock including mineral components, grain size, and texture

low-level waste — radioactive waste not classified as high-level waste, transuranic waste, spent nuclear fuel, or by-product material

mass spectrometer — an instrument that determines the mass (and hence the type and relative number) of atoms in a sample by electronically ionizing the sample and then varying the atomÕs trajectories in a mass-dependent way in a magnetic field

microflora — microscopic plants

mill tailing — a typically sandy, high-volume waste product of the process of extracting uranium metal from ore samples

mixed waste — waste that exhibits both radioactive and hazardous characteristics

natural attenuation — reduction in contaminant toxicity, mobility, or volume through the operation of naturally occurring processes (e.g., dilution, dispersion, sorption, biodegradation, volatilization, and chemical stabilization) rather than through actively engineered systems

noble — elements that do not react chemically

nonthermal system — a system that operates at temperatures below 350°C (662°F)

off-gas — vapors and gases (including air) given off during a process

orthophoto — a photographic copy, prepared from a photograph formed by a perspective projection, in which the displacements due to tilt and relief have been removed

oxidation — (1) a chemical reaction in which a molecule or ion “gives up” an electron to another molecule or ion (2) a chemical combination of a material with oxygen

permeability — the degree to which a solid contains pores or openings through which a liquid or gas can pass

phytoextraction — removal of chemical substances by plants

phytoremediation — removal of contamination through the natural process of plant uptake

piezoelectric — having the ability to generate a voltage when mechanical force is applied or to produce a mechanical force when a voltage is applied

pilot-scale demonstration — small-scale equipment (but larger than bench scale) used to test the practical aspect of a new technology or process

plasma — an ionic state of matter in which the positively charged nuclei of atoms have been completely separated from the atom's negatively charged electrons

plume — an elongated and usually mobile band of contamination (e.g., in ground water)

polishing — removal of final trace impurities

polymer — long chain or crosslinked chemicals, with multiple repeating chemical units (e.g., nylon and plastics)

polymer macroencapsulation — using a leach-resistant plastic to fully encase large pieces of a solid, contaminated waste such as lead, bricks or debris in a specially designed container

polymer microencapsulation — encasing particulate, powdered, or granular wastes in a leach-resistant plastic

pyrolysis — the breaking apart of complex molecules into simpler units by the use of heat

radioactive waste — a solid, liquid, or gas of negligible economic value that emits radiation in excess of threshold quantities

Raschig ring — a type of separation or absorption column packing in the shape of short hollow cylinders

reactive metal — a metal predisposed to chemically combine with other substances or contaminants rendering them less hazardous

reagent — a substance capable of chemical activity in a given chemical environment

real time — receiving data and analysis of a given operation during that operation, rather than sending samples to a laboratory and receiving data later

reduction — a chemical reaction in which a molecule or ion effectively acquires an electron from another molecule or ion (opposite of oxidation)

refractory — a heat-resistant, nonmetallic mineral

riser — a pipe extending from an underground storage tank to the ground surface

salt cake — a dry, hard layer of chemical salts resulting from the neutralization of acids used during the extraction of plutonium from spent nuclear fuel

scabbling — removal of contaminated surface layers through the use of mechanical impact

sludge — a precipitated solid/liquid mixture produced by manufacturing or waste treatment processes

sluicing — using a stream of liquid (usually water) to mobilize and remove solids

slurry wall — a barrier to prevent ground-water flow created by pouring an impermeable mixture of clay and water into the ground in advance of a plume's potential migration path

solvent extraction — a type of separation technology in which specific chemical species are extracted from a water-based liquid into any organic liquid

sorbent — a material that can extract a target molecule from a solution and bind it to the material

spalling — chipping or fracturing of concrete with specially designed bits

sparging — the process of bubbling air through water to remove undesirable dissolved gases

spectroscopy — the branch of physics concerned with the production, measurement, and interpretation of electromagnetic spectra arising from either emission or absorption of radiant energy by various substances

spent nuclear fuel — highly radioactive material that has been used for power generation or isotope creation in a nuclear reactor

stabilization — a process designed to limit the mobility of toxic chemicals

stakeholder — any person or group affected by the potential outcome of DOE decisions

supernatant — liquid residing above sludge in a storage tank

thermal desorption — a process that uses heat to convert liquids into a gas, allowing them to be removed from solids

thermal system — a system that operates at temperatures over 350°C (662°F)

thermogravimetric — the measurement of weight changes of a system or compound as a function of increasing temperature

tomography — the reconstruction of the three-dimensional internal structure of an object through the mathematical analysis of signals (such as X-rays or seismic waves) received at multiple locations after passing through the object

transite — an asbestos-containing material used to manufacture fireproof structural building panels

transuranic waste — waste that consists of radionuclei with atomic weights greater than that of uranium and having a half-life of more than 20 years

treatability study — a study to determine the efficacy of one or more potential treatment methods or processes on a given remediation problem

tritiated — pertaining to matter in which atoms of tritium (a form of heavy hydrogen with a mass number of 3) have replaced one or more atoms of ordinary hydrogen

upgradient — the direction from which ground water flows

vadose zone — the area between the surface and the water table and, therefore, not completely saturated with ground water

vapor stripping — the process of aerating contaminated groundwater, causing dissolved contaminants to vaporize so they can be captured and treated

viscosity — the measure of a material's resistance to flowing

vitrification — any thermal process for converting wastes into a stable, glassy form

volatile — readily passing into the vapor phase by evaporation

waste heel — a layer of material lying below sludge in a waste tank, which can be formed by the settling and/or reaction of the oldest and heaviest material in the tank and is resistant to removal (material remaining in a tank after removal operations are complete)

waste stream — waste (liquid, solid, or gas) leaving a facility or operation